THE CHARLES STARK DRAPER LABORATORY
A DIVISION OF MASSACHUSETTS INSTITUTE OF TECHNOLOGY
68 ALBANY STREET
CAMBRIDGE, MASSACHUSETTS 02139

MEMO

To: Russ Larson

From: Don Eyles

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Subject: Notes on CDU Back-up

This memo includes some notes on the operation of the CDU back-up erasable program.

Restarts

At several moments during the landing and ascent the CDU back-up erasable program is vulnerable to a hardware restart. It is never, once activated, vulnerable to a software restart, because only on hardware restarts is DNTMGOTO (cell 0335) reset. Once Servicer is running the moments of vulnerability are few because two conditions must obtain: (1) AVGEXIT must be reset to some value other than 661, the starting address of the 2 second program, and (2) group 1 must be dead — the group is used for protection by the 20 ms. routine, but also by various one-time activities, such as the ullage task and the antenna repositioning.

Between loading the erasable program and activation:

If a restart of either type (including V37) occurs during this period, the erasable program should be checked before activation. On a restart cells 263, 277 and 313 are reset to 00000 (instead of 77776) indicating core sets 6-8 are free, and cell 660 (VAC5USE) is set to 00660 (instead of 00000) indicating Vac 5 is free. There is thus then a slight danger that some program could be assigned these areas and clobber the erasable program. This is an argument for activating the erasable program as soon as it is loaded and checked.

Between activation of the erasable program and TIG-30:

If a software restart is immediately followed by a hardware restart the program may be deactivated. To reactivate simply repeat V 21 N 1 E 335 E 250 E.

After Servicer is on:

The erasable program may be vulnerable to hardware restarts occurring at TIG-30 and following V 37 E 70 E or V 37 E 71 E. These are moments when AVGEXIT is reset and group 1 is dead. To reactivate: V 21 N 1 E 335 E 250 E.

CDUX-only Failure

In the earlier memo I said that if CDUX was the only CDU failed, the erasable program need not be used. However, a bird pointed out that if CDUX were runaway, the erasable program would be needed to constantly plug zero into CDUX so that the LR could be used.

When Error Needles are Usable

When the failed CDUs are frozen, and the erasable program is operating, N22 would be valid and the attitude-error needles would be usable — if the DAP were on. And there is no reason to have it off in this case, because frozen CDUs should cause no time-loss.

N87 for FDAI

On the question of how closely the CDUDs displayed in N87 correspond to FDAI pitch and roll, this seems to be the case: (1) if yaw = 0, R1 gives pitch and R2 gives roll accurately, (2) if roll = 0, then regardless of yaw R1 is accurate for pitch, and (3) if yaw and roll are non-zero, R1 and R2

are not equivalent to FDAI pitch and roll, but for the small ($< 3^{o}$) roll angles normal for a landing (even a moderately out-of-plane one, on the order of 20000 feet), they are accurate enough to be used. Anyway, when the LM is yawed to zero to get radar data, R1 and R2 become accurate. In conclusion, there is no reason to sacrifice the 50^{o} yaw contemplated for S-band reasons.